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May 17, 1995

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

Mr. William R. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

Re: CC Docket No. 92-297
IC Docket No. 94-31

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules and regulations, Motorola, Inc. hereby reports that an ex parte presentation was made on Thursday, May 11, 1995 by representatives of Motorola to Thomas Tycz, Donna Bethea, Donald Gips, and Gregory Rosston of the Office of Plans and Policy to discuss issues addressed in Motorola's comments and reply comments in the above-referenced proceedings as well as the Report of the LMDS/FSS 28 GHz Negotiated Rulemaking Committee in CC Docket No. 92-297. This meeting was scheduled in accordance with Public Notice (DA 95-663) dated April 5, 1995, in CC Docket No. 92-297. The attached document addresses points that were discussed at the meeting. Two originals and two copies of this letter and attachment thereto are being submitted for inclusion in each of the above-referenced dockets.

Sincerely,

Pantelis Michalopoulos

Pantelis Michalopoulos
Attorney for Motorola, Inc.

Enclosure

cc: Thomas Tycz
Donna Bethea
Donald Gips
Gregory Rosston

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SPACE FREQUENCY COORDINATION GROUP WORKSHOP

**ITU-R Sharing Studies between 20/30 GHz GSO/FSS networks and Non-GSO
Feeder Links for MSS Operating in the 1-3 GHz Frequency Bands**

Prepared by:

Kenneth Engle

Motorola, SATCOM Div.

April 15, 1995

1.0 Introduction

In 1993 and 1994, ITU-R Task Groups and Working Parties addressed various aspects of technical and operational constraints for the feeder links of Non-GSO/MSS networks which have their service links in the 1-3 GHz spectrum and are co-primary with GSO/FSS. From these studies, suggestions for operational and regulatory changes to the Radio Regulations were made. These studies and recommendations were summarized in a consolidated report, CPM95/6 prepared in Dec. 94. Because of the compressed schedule between WARC-95 and the complexity of these technical studies, some of these studies were considered preliminary and in some areas further work was indicated. However, these Task Groups are not meeting in 1995 and it is up to the CPM and finally the WARC-95 itself to decide whether the studies are sufficient to make recommendations for changes in the Radio Regulations. The CPM concluded its work on April 5, 1995 (CPM95/118) and no consequential changes were made to the draft technical and operational studies conducted earlier or to a list of suggested options of changes to current regulatory/procedural aspects of the Radio Regulations. However, some additional sharing studies were provided directly to the CPM and are considered in this review.

The following sections examine various elements of these studies with regard to their technical completeness and conclusions. Of special concern to Motorola is the applicability of these studies to the Iridium® system currently developing a world wide Non-GSO/MSS feeder link network in the 20/30 GHz band and is planning to commence world wide MSS operation in 1998.

2.0 Network Characteristics

The general characteristic of networks for both Non-GSO/MSS feeder links and GSO/FSS used in the various 20/30 GHz sharing studies can be categorized as below:

GSO/FSS

- a- VSATs with earth terminal beam widths 1 degree or greater and narrow band data operating with regenerative transponders
- b- Wide band traffic links with earth terminal beam widths of about 0.1 degree operating with transparent transponders

Non-GSO/MSS Feeder Links

- a - All earth terminals have beam widths about 0.1 degree and track steerable satellite spots.
- b- Some satellites are regenerative transponders carrying moderate bandwidth data
- c- Some satellites were transparent and carrying narrow band voice channels employing either TDMA or CDMA access techniques.
- d- Some satellites are in low circular earth orbit (LEOs) and others in high (ICO)

Based on these diverse characteristics it is obviously going to be difficult to develop general sharing conclusions or interference mitigation techniques. There are no ITU-R recommendations on service objectives and/or interference budgets for GSO/FSS systems in the 20/30 GHz band as well.

3.0 In Line Interference Geometry's

The Non-GSO satellites are in motion relative to GSO satellites and the Non-GSO earth terminals are continually tracking their satellites. Therefore, the peak interference between the two types of satellite systems are transitory and semi-random in occurrence. These interference peaks occur when one of the geometry's described in Figures 1 to 4 should happen along with co-frequency operation. The distance between the respective earth terminals is frequently used as a parameter. All Non-GSO systems have circular orbits but the height ranges from about 800 km to 10,000 km. Most studies considered a full constellation of Non-GSO satellites with one feeder link earth terminal and one co-frequency GSO with a single earth terminal.

DIAGRAMS OF INTERFERENCE CONDITIONS

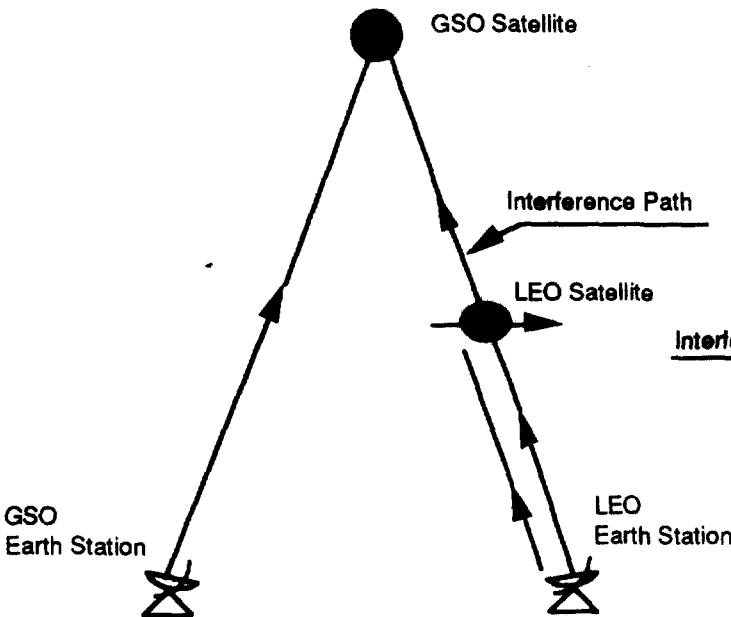


Figure 1
Uplink LEO Interference into GSO

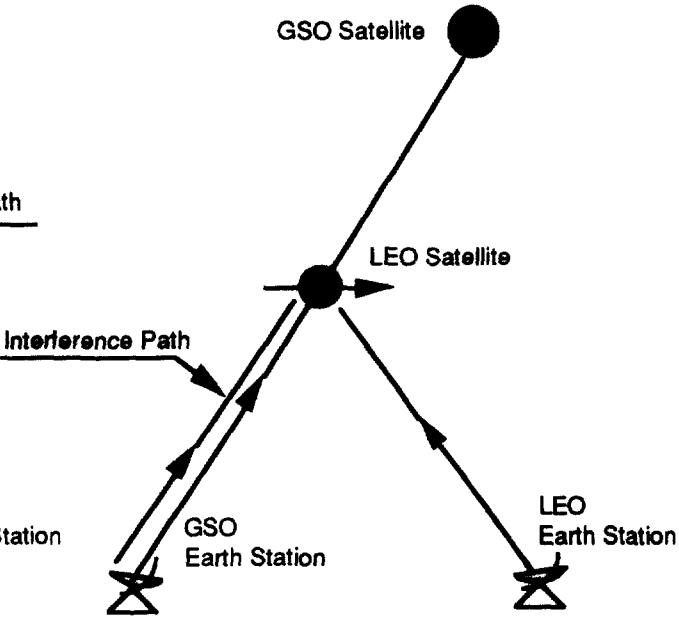


Figure 2
Uplink GSO Interference into LEO

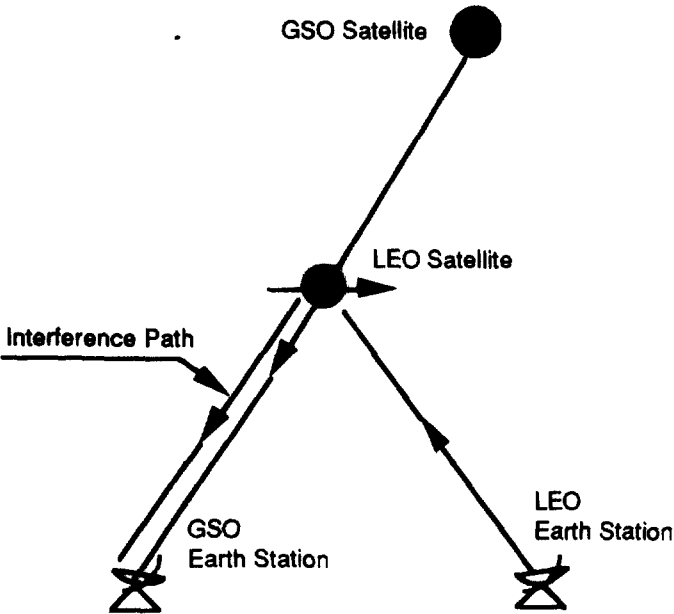


Figure 3
Downlink LEO Interference into GSO

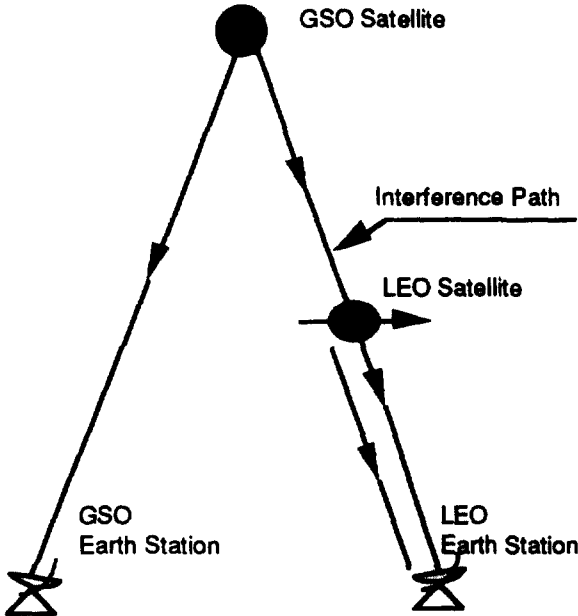


Figure 4
Downlink GSO Interference into LEO

4.0 Service Objectives /Service Quality/Interference Budgets

Historically the FSS had developed a set of service objectives and service quality that paralleled the same objectives as trunked wire line or point to point microwave. Long term Intra-service interference budgets were developed between co-frequency GSO networks that would allow efficient utilization of the arc and allow each network to meet its service objectives. These budgets allowed the arc to be fully utilized with transparent transponders carrying trunking traffic in the 6/4 and 14/12 GHz bands which ultimately accommodated wide band video as well.

In 1994 TG 4/5 undertook studies of interference budgets for GSO/FSS links sharing the same frequencies as Non-GSO/MSS feeder links. It was recognized that interference events between these two types of networks were of a short term nature and new interference budgets would have to be established. TG4-5/33 was a contribution from INTELSAT that assumed that all future GSO systems would mostly be carrying digital traffic and the performance requirements of Recommendation ITU-R(Doc. 4/277) were used as objectives. Allowable short term budgets for interference from Non-GSO feeder links were derived based on link margins and propagation statistics.

A subsequent contribution from INTELSAT (TG4-5/66) expanded the analysis to include GSOs operating at 20/30 GHz. This contribution recognized the difficulty of meeting the service objectives due to practicality of achieving sufficient link margins at these frequencies where rain attenuation is severe. Never the less, by assuming the GSO would use site diversity for its earth stations and be only located in moderately rainy climatic zones (E), a set of short term criteria for interference from Non-GSO was derived based on a allocation where degradation from Non-GSO was set at 10% of the outage time estimated due to atmospherics. It was noted that the GSO could not meet these service objectives in more severe climates so the budgets for interference from Non-GSOs could be increased in those regions.

These interference allowances for interference from Non-GSO/MSS into GSO/FSS are summarized in Table 1 (Table 8A CPM95/118).

Table 1 20-30 GHz Networks	
I	% of time
Negligible	0.87
0.78Nt	0.119
2.98Nt	0.0294
14.8Nt	0.0004

In 1994, TG 8/3 was solicited for short term interference criteria/service objectives for the various proposed Non-GSO/MSS systems and could only provide the one criteria summarized in Table 2 (CPM95/118 Table 8B) which was only applicable to the 4-8 GHz bands and is more stringent than the criteria for interference established for GSOs. No technical rationale was provided for this criteria.

Table 2 For 4-8 GHz Non-GSO Networks	
I	% of time
0.03N _t	0.100
0.20N _t	0.010
0.70N _t	0.001

Iridium (LEO A in ITU-R Table of Characteristics), an Non-GSO/MSS network with 66 satellites and feeder links in the FSS 20/30 GHz band, has been in development for several years now and has been endeavoring to develop a design that would maximize its service objectives everywhere in the world. As previously noted, atmospherics can be a significant limitation in many climatic zones of the world. In addition, LEO A feeder link stations must operate to elevation angles as low as 5 degrees in the lower latitudes. Not only are atmospherics a bigger problem at these low elevation angles but the potential for interference into up links from FS is increased as well.

LEO A carries trunking type digital traffic consisting of telephony from its service links either direct from the service links of a single satellite or relayed through its intersatellite links, administrative data across the network, and telemetry data from the satellites. The service quality requirement for these links is a BER of 10⁻⁷ or better. This system uses adaptive power control for both range compensation and rain attenuation. Satellite prime power and other technical limits require that the nominal margin for unexpected short term interference events be limited to about 3 dB. Therefore, an interference to noise ratio (I_o/N_o) of about -1 dB is threshold above which the system quality objectives would not be met.

A budget for the allowable time allocated for external short term outages as a function of earth station site design and climatic location is still being developed along with detailed service objectives and technical means to achieve those objectives. Because of the atmospheric statistics in the 20/30 GHz band, using a criteria based on annual outage percentages as proposed for GSO networks, may not be satisfactory to a user in certain climatic zones. Monthly maximum percentages may in fact be more appropriate.

However, Motorola proposes to examine the feasibility of sharing with GSO/FSS systems with the following nominal criteria for short term interference from the GSO networks on the assumption an annual availability of 99.8 % can be achieved for an average gateway earth station. Therefore, if the interference outage is budgeted about 10% of the atmospheric, then:

I = .79N_t for .01% of time on an annual basis cumulative per up and down link

It should be noted that LEO A is a processing satellite with steerable spot beams and outages could independently happen between the up and down links. Similarly, GSOs with spot beams could also encounter independent outages.

Motorola does not suggest that this short term Non-GSO criteria should be applied to other Non-GSO/MSS feeder links at 20/30 GHz band. To date, all other proposed MSS systems employ transparent transponders carrying mostly extensions of service link narrow band voice and data over their feeder links. The availability of hand held earth terminals in the service links is not high relative to what can be achieved on the feeder links with large tracking antennas so probably the driver on the overall availability is the service links. Short term interference budgets for these networks should be set accordingly.

Finally, any new system/service will have its service objectives ultimately determined by the market place. Services provided by such systems as Iridium will be tested in the market place by customers who will set the final cost/service objectives for a successful new system.

5.0 Interference from Non-GSO networks into GSO networks

5.1 Large GSO Earth Terminals(> 3.0 meter)

Intelsat (TG4-5/106-E) developed a computer simulation for studying the potential for interference from Non-GSO MSS feeder links into a hypothetical KaBand GSO network. The straw man GSO used in the simulation had its link margins set such that service objectives of ITU-R S.1062 could be met in a moderate climate zone using site diversity. The Non-GSO satellite characteristics were those of LEO A and the GSO used spot beams and evaluated links to earth terminals ranging in size from 1.2 to 5.5 meters ($\ll 1.0^\circ$). (LEO A has 3.0 meter antennas)

It was concluded that the most severe event occurred in the down link to the GSO terminals. This is not surprising since, on the average, there is 30 dB additional range loss on the up link to the GSO arc so it is unlikely a Non-GSO would interfere with a GSO satellite on the up link. On the down link the outage time was greatest into the 1.2 meter station with the widest beam width. These terminals suffers outages that are 25 times longer than the allowable budget. Intelsat then concluded that sharing at KaBand is only feasible if the Non-GSO "ceases transmissions or by carefully choosing the pointing of the earth station and Non-GSO satellite antennas" i.e. orbit avoidance.

This Intelsat analysis illustrates the complexity of accurately modeling the sharing problem between Non-GSO and GSO networks particularly in frequency bands where large link margins are required. It appears that the LEO EIRPs were assumed to be constant and set at the values published for the fully faded case at near maximum range to the LEO earth station. LEO A uses range compensation and automatic power control to compensate for rain attenuation. A 3 dB running margin is maintained at all times if possible for transient interference protection.

With the LEO A power control strategy as described above, a more realistic simulation would have used the clear air down link power from LEO A consistent with the elevation angle of the GSO earth terminal. The probability that LEO A would be powered up to overcome a rain event while crossing an in line interference geometry, is extremely low. Also, on the up link, if LEO A powers up to overcome a rain cell, that cell probably blocks the increased power to the GSO as well. The more realistic simulation is to assume LEO A interference powers are the clear air levels adjusted for range to maintain a 3 dB running margin.

The geographic placement of the earth stations was at a latitude of 60° north so that the elevation angle to the earth stations was 10° to the GEO arc. It is not possible to deduce the effect at lower elevation angles from this analysis. Additionally, "no satellite antenna discrimination patterns were used". Probably, that means they only used 3 dB beam widths which however, does not induce a big error for these narrow beam antennas.

With the assumptions used in this analysis sharing between Low Earth Orbiting Non-GSO networks and GSO appears to be not feasible without "orbit avoidance" by the Non-GSO earth stations. It is difficult to determine whether the conclusion would change if the more realistic assumptions on power control were used at lower latitudes.

United Kingdom (TG4-5/86) also performed simulations of interference between Non-GSO and GSO networks at Ka-Band. Earth stations located at different latitudes were considered and for LEO A, the interference at both minimum EIRP and maximum were considered. As with the Intelsat paper, the same short term interference criteria was used for digital links and GSO link margins. It was concluded that there is acceptable levels of interference into the GSO network on the up link but not on the down link. In all cases the GSO network employed earth terminals with beam widths about 0.1° , site diversity and the link margins as proposed by Intelsat.

If a single satellite of the 66 constellation LEO A is considered, the short term interference requirements of the GSO can be met. But the impact of all 66, which in fact would be operating to a single earth station in sequential time, it becomes excessive on the down link into a GSO earth terminal. This contribution concludes "The results when extrapolated for interference from a constellation of Non-GSO satellites show that in the majority of the cases the small time percentages of allowable interference to digital carriers will not be met.." Also, the criteria of C/I for TV service was also unacceptable.

Table 9 Section 3.1.3 of CPM95/118 summarizes the results of these sharing studies and largely based on the UK paper TG4-5/86. The entries on interference into GSO for 20/30 GHz band generally tend to support the conclusions of the previous two studies just cited. No problem from up link if from a LEO with characteristics like LEO A but excessive short term interference into the down link from a LEO.

5.2 VSAT GSO Earth Terminals

US CPM95/15A (DRAFT) is a detailed study by Hughes Aircraft which considers the case of LEO A Non-GSO sharing with a GSO (Spaceways) linked with a number of VSATS at KaBand with both 1 and 3 degree beam widths. Simulations were run with co-located earth terminals at US CONUS latitudes. Clear air power levels were assumed for both up and down links.

A series of interference events and levels were run of the 66 constellation against a single GSO satellite and an associated earth terminal. The cumulative probability distribution is plotted of the I/N into the GSO network receivers.

It is unclear what budget allocation should be made for short term interference into the Hughes GSO receivers as the link margins are not consistent with the model proposed in Table 1 for transparent transponders and where GSO earth terminal site diversity is not employed. This GSO is a processing satellite with asymmetrical links. However, the probability distribution plots indicate, as expected, that the down link into the GSO earth terminals is the dominant interference problem into the GSO network.

It is unclear on how to translate this data to a collection of co-frequency VSATs scattered among the GSO spot beams or to the case when the GEO arc is fully loaded every 2 or 3 degree with co-frequency GSO satellites.

CPM95/25 was a contribution to the CPM from Canada which considered mutual interference between ICOs LEO B (CDMA) and LEO F (TDMA) and Canada's Advanced Satcom which plans to use narrow band VSATs earth terminals about 20 cm in diameter in the 29.5 - 30.0 GHz sub-band. Neither up link or down link interference into the GSO earth terminals was a problem with LEO B due to the spreading of the CDMA signal. LEO F had very short interference events on the down link and very short but intense interference events on the up link. It was concluded that all interference events into the GSO network would be acceptable to the GSO network.

6.0 Interference from GSO networks into Non-GSO networks

6.1 Large GSO Earth Terminals

United Kingdom (TG4-5/86) appears to be the most definitive input on this scenario. For the case of the MSS LEO A being the victim network, the up link interference is the most severe as the GSO must overcome the 30 dB increased range loss. This study indicated that the short term interference criteria of 70%Nt would be exceeded for 0.11% of the year with up to 28 short term outages per day. It is unclear of what power programming strategy was attributed to LEO A for this analysis. In their earlier paper (TG 4-5/69), their statistics for the same scenario at the equator use clear air and full up link power from the LEO. This gave a 7.42% cumulative probability distribution for the clear air and .069% if LEO A powered up to overcome interference. This data was not repeated in TG4-5/86 so it is hard to deduce the true state of affairs. However, these availability statistics are all much poorer by several orders of magnitude than that required by Iridium.

The summary of sharing studies in Table 9 (CPM-95/118 Section 3.1.3) only shows the availability statistics for the 14.8Nt level at .008% with a mean time between events of 3 hours for this interference scenario. Motorola is unable to use this table to determine the statistics for a 79%Nt. However, in checking TG4-5/86, it appears that the cumulative probability of outage at 0.78Nt would exceed 0.1%. Far in excess of the allowable short term allowance for LEO A of .01%.

Since the GSO also has high gain earth terminal antennas, it appears that the down link pfd's are comparable and the excess interference into the narrow beam Non-GSO's occurs for only short periods of time. Some form of preprogrammed power control on the part of the Non-GSO could mitigate interference levels in this scenario.

6.2 VSAT GSO Earth Terminals

CPM95/25 proposed that LEO B could tolerate an up link C/I of no more than 0.3 dB for less than 0.12% of the time. Their simulation indicated that the up link C/I was 25 dB less than this limit and clearly mitigation techniques were required. Severe up link interference was also noted with LEO F.

US CPM95/15A (DRAFT) study indicated that the cumulative probability distribution for an I/N greater than 79% into LEO A up link would be exceeded for greater than 0.5% of the time and with events lasting up to 24 seconds. This would seriously degrade the service objectives of LEO A.

7.0 Interference Reduction Mechanisms

Section 3.1.5 Part C of the CPM95/118 discusses in a qualitative manner a number of "principles" that could be employed to reduce interference levels and frequency of the in line events. These principles are examined below for the LEO A system with its moderate data rates, power programming strategy, and stringent service quality requirements for its feeder links.

Adaptive Power Control

It is possible for LEO A to preprogram the up link and down link signal levels in anticipation of an excess in line event into its network. However, when operating to an earth terminal at low elevation angles this power control range is limited. If frequent power adjustments of the down link were required, then prime power consumption could be a problem i. e. numerous co-frequency terminals and a full GSO arc. The amount of power control required is reduced if large geographic separation between earth terminals is practical.

Geographic Isolation

If the GSO employs spot beams that do not have 100% frequency reuse, then some interference reduction is possible with geographic separation. However, GSO spot beams at these frequencies are at least several hundred miles across and therefore the geographic separation might impose unreasonable constraints on either service. If multiple co-frequency GSOs are spaced along the arc it is difficult to see how even this technique would be effective. The Canadian study of VSATs sharing with ICOs indicated geographic isolation between co-frequency earth terminals of up to 1000 km might be required.

Use of High Gain Antennas

The studies certainly indicate that the frequency of the in line interference events is reduced if both systems use high gain earth station antennas ($\approx 0.1^\circ$ beam width). Unfortunately, it is impractical to employ such large apertures on Non-GSO/MSS spacecraft. Clearly, numerous VSATs with low gain antennas cannot share as readily as GSO networks with a few high gain earth terminal antennas.

Path Diversity

- **Satellite Diversity:** It is suggested that it is "conceptually" possible to switch to an alternative Non-GSO satellite to avoid an in line event if inter satellite links are employed. The LEO A system employs inter satellite links but visibility statistics of the 66 satellite system at mid or lower latitudes preclude this possibility. Switching back and forth between gateway stations is also impossible without large periods of interrupted service as by necessity the satellite switches are not easily reprogrammed from the earth and reestablishing connections to the local PSTN from another gateway thousands of miles away is not possible without further outages. Other proposed Non-GSO constellations are considering using satellite diversity for their service links and might permit this type of mitigation.
- **Site Diversity:** The Iridium system might employ site diversity to increase availability in some climatic zones. Site diversity spacing is restricted to about 50 km due to problems of differential delay at the moderate data rates combined with atmospheric statistics. This would do nothing to alleviate the major interference event of the GSO up link into the spacecraft antenna side lobes as seen in Figure 2 or down link into GSO as seen in Figure 3.

8.0 Non-GSO/MSS Sharing with FS

It must be remembered, that an additional constraint on the Non-GSO/MSS and GSO networks is the requirement for sharing with FS on most sub-bands in the 20/30 GHz spectrum. Iridium avoided placing its feeder links in the sub-band 29.5-30.0 / 19.7-20.2 as the band is allocated for MSS, has no FS and therefore no down link pfd limits. Therefore, this band was considered to be most likely exploited by GSO VSAT systems. On the other hand, the rest of the sub bands have FS allocations on a co-primary basis. Motorola's initial assessment was, that coordination was possible with FS using the coordination procedures of Appendix 28 as modified by Rec. 749 and 747. Conventional FS uses narrow beam antennas and mode 2 propagation distances are short in the 20/30 GHz band. Motorola participated in the 1994 US Negotiated Rule Making relative to sharing with a Local Multipoint Distribution Systems, a FS network consisting of omni broadcasting antennas and concluded sharing was possible with certain constraints on both services. It notes that the NRM concluded that sharing was not possible with GSO VSAT systems. It is difficult to believe that an LEO A like system could successfully coordinate with FS and VSAT type GSO networks even if all were on a co-primary status.

9.0 Conclusions

Section 3.1.8 of CPM95/118 concludes that **"by use of interference reduction mechanisms, frequency sharing may be possible at 20/30 GHz in some cases"** It should be noted that this conclusion is based on simulations which used an interference criteria for Non-GSO/MSS networks which is an order magnitude too relaxed for a system like Iridium. However, it is generally true, that where practical interference reduction techniques can be employed such as geographic separation and adaptive power control, that interference **into** GSO networks may be kept to permissible limits if there is only a single GSO satellite within the field of view of the Non-GSO earth station and its earth terminal antenna is narrow beam. No simulations were performed with multiple GSO satellites within the field of view.

All studies show that the up link interference into a LEO or ICO is the dominant problem. Recent experience in coordinating between LEO A (Hibleo 2) and GSOs in Italy and Japan bear this observation out. Both countries use large aperture earth terminals and spots on their spacecraft, but it is not possible to achieve geographic separation sufficient to protect the Non-GSO up link from unacceptable peak interference events. Both systems operate their uplink earth stations at full power all of the time. And of course, for both these cases studied, there is only one co-frequency GSO satellite in the field of view of the Non-GSO earth station.

CPM95/118 goes on to conclude that, **"in parts of the 20/30 GHz bands allocated to both FSS and MSS(i.e. RR 873B) where small (approximately 0.2 m diameter antennas) and mobile earth stations are used by the GSO networks, sharing between such networks and Non-GSO/MSS feeder links would place severe constraints on the GSO networks for protection of the Non-GSO/MSS networks"** These conclusions are the result of sharing studies between ICO MSS networks and VSAT GSOs. There is reason to conclude the situation would be worse with a LEO due to the increased range differential on the up link.

10 Proposed Recommendations for Further ITU-R Studies

To date, there has been negligible utilization of the 20/30 bands for GSO FSS with its 5.0 GHz combined up and down link bandwidth available every few degrees of the arc. The sharing studies conducted to date, show there is no possibility of co-frequency sharing between Non-GSO/MSS feeder links as planned by LEO A or LEO B and VSAT GSO/FSS networks. Sharing may be possible with networks consisting of large aperture GSO terminals and Non-GSO/MSS feeder links if there is only a few co-frequency GSOs in the visible arc.

Clearly studies need to be performed on utilization of the 20/30 GHz spectrum by GSO/FSS networks in order to develop recommendations on the most efficient utilization of these bands. The studies from the lower bands cannot be simply extrapolated because of the dramatic increase in rain induced fades. Strategies for power programming to overcome these rain induced fades is a crucial parameter in these studies particularly if VSAT networks are to be sharing the arc most efficiently. It should be noted that frequency reuse within a network due to polarization is also not practical in this band due to atmospheric affects.

In addition, further studies are required by Non-GSO/MSS feeder links in these bands particularly on co-frequency operation. Since the current proposed Non-GSO networks are quite different in network characteristics, it will be difficult to establish recommendations for optimum use of the band. Initial studies of Non-GSO/Non-GSO feeder link sharing are quite encouraging as long as the satellite employs steerable spot beams, the density of co-frequency earth stations are low, and the earth stations have large apertures (≈ 3 m.). However, only LEO A has proposed a short term interference allowance and an adaptive power programming strategy to justify its allowance. Other Non-GSO/MSS feeder link proponents need to contribute more mature network characteristics before these studies could be considered definitive.

It is anticipated that all these studies would take several years to complete but several Non-GSO/MSS operators are in development today. CPM95/118 contains two regulatory options for consideration by WARC95 on how to accommodate sharing between GSO/FSS networks and Non-GSO/MSS feeder links. The first option requires coordination on a co-primary basis but as can be seen from current studies, it is questionable whether unreasonable constraints are likely to be imposed on either type of networks in order to share a band. Motorola therefore recommends the second option described in CPM95/118 as follows:

This option "identifies certain sub-bands in the 17.7-19.7 GHz and 27.5-29.5 GHz bands be used primarily by Non-GSO/MSS as it guarantees future access to all FSS applications. This second option would entail the following:

- RR 2613 (S22.2) would be waived in those sub-bands identified for use primarily by Non-GSO/MSS feeder link networks
- accommodations of existing GSO/FSS networks would be provided such that they would continue to have equal status with respect to Non-GSO/MSS feeder link networks in those specific sub-bands
- within these specific sub-bands, future GSO/FSS networks would not cause harmful interference to, or receive protection from, Non-GSO/MSS feeder link networks.

It is further believed, that the sub-band 29.0-29.5/19.2-19.7 should be designated for Non-GSO/MSS feeder links as it is unlikely to be suitable for GSO VSATS and has the fewest GSO/FSS incumbents to date. So far, four systems have been advanced published for MSS feeder links in the 20/30 GHz bands including one GSO/MSS system. It could well be that a full 500 MHz up and down could be required to accommodate just these initial systems. There are a number of Non-GSO/MSS networks seeking new allocations for their feeder links at lower frequencies. Some of these networks could end up in the 20/30 GHz band as well.

As can be seen, the ITU-R technical and regulatory processes are being sorely tested due to the rapid evolution of communication systems exploiting a limited resource called "frequency spectrum".